What is claimed is:

1.   A servo-valve control device for controlling servo-valve opening, so that the servo-valve opening may follow a target by inputting signals of a servo-valve opening target value and of an actual servo-valve opening, the control device comprising:

a controller, which is constructed to receive a signal of difference between the servo-valve opening target value and the actual servo-valve opening, and to generate a servo command signal for driving the servo valve;

an extended observer, which is constructed to receive the actual valve opening signal and the servo command signal, and to estimate an input-terminal disturbance signal added on the servo valve; and

a modification part, which is constructed to modify the servo   command   signal   by   subtracting   the   estimated input-terminal disturbance signal output from the extended observer, from the servo command signal.

2.   The servo-valve control device according to Claim 1, further comprising a signal limiter which is constructed to receive the servo command signal and to limit the servo command signal within a pre-determined range.

3.   The servo-valve control device according to Claim 1,

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wherein the controller includes a null bias compensator which is constructed to add a compensation signal to the servo command signal for compensating a null bias contained in the servo valve.

4. The servo-valve control device according to Claim 1, wherein the extended observer is constructed to model the servo valve using a system matrix and an observer matrix which are independent of characteristic parameters of the servo valve.

5. The servo-valve control device according to Claim 1, further comprising an abnormality detector for detecting an abnormal condition of the servo-valve control device based upon output of the extended observer.

6. A servo-valve control device for controlling servo-valve opening, so that the servo-valve opening may follow a target by inputting signals of a servo-valve opening target value and of an actual servo-valve opening, the control device comprising:

a controller, which is constructed to receive a signal of difference between the servo-valve opening target value and the actual servo-valve opening, and to generate a servo command signal for driving the servo valve;

an extended observer, which is constructed to receive the actual valve opening signal and the servo command signal, and

to estimate an input-terminal disturbance signal added on the servo valve; and

a function generator, which is constructed to tune at least one control parameter of the controller based upon the disturbance estimation signal from the extended observer.

7. The servo-valve control device according to Claim 6, wherein the controller includes a null bias compensator which is constructed to add a compensation signal to the servo command signal for compensating a null bias contained in the servo valve.

8. The servo-valve control device according to Claim 6, wherein the extended observer is constructed to model the servo valve using a system matrix and an observer matrix which are independent of characteristic parameters of the servo valve.

9. A servo-valve control device for controlling servo-valve opening, so that the servo-valve opening may follow a target by inputting signals of a servo-valve opening target value and of an actual servo-valve opening, the control device comprising:

a controller, which is constructed to receive a signal of difference between the servo-valve opening target value and the actual servo-valve opening, and to generate a servo command signal for driving the servo valve;

an extended observer, which is constructed to receive the actual valve opening signal and the servo command signal, and to estimate an input-terminal disturbance signal added on the servo valve;

a null bias compensator which is constructed to add a compensation signal to the servo command signal for compensating a null bias contained in the servo valve; and

a tuner for tuning at least one setting value of the null bias compensator, based upon the disturbance estimation signal from the extended observer.

10. The servo-valve control device according to Claim 9, wherein the extended observer is constructed to model the servo valve using a system matrix and an observer matrix which are independent of characteristic parameters of the servo valve.

11. A servo-valve control system for controlling a servo valve, the control system comprising:

(a) a triplex system of valve-opening detectors for obtaining actual valve opening signals of the servo valve;

(b) a triplex system of servo-valve control devices each including:

a first middle value gate for selecting a middle value of the actual valve opening signals of the servo valve;

a controller, which is constructed to receive a signal of difference between the servo-valve opening target value and the

middle value of the actual servo-valve opening, and to generate a servo command signal for driving the servo valve;

an extended observer, which is constructed to receive the actual valve opening signal and the servo command signal, and to estimate an input-terminal disturbance signal added on the servo valve; and

a modification part, which is constructed to modify the servo command signal by subtracting the estimated input-terminal disturbance signal output from the extended observer, from the servo command signal;

(c) a triplex system of valve interfaces each including:

a second middle value gate for selecting a middle value of the servo command signals from the servo-valve control devices; and

a power amplifier which is constructed to amplify the servo command signal from the second middle value gate to drive one of the servo valves; and

(d) a triplex system of servo coils for driving the servo valves with current from the valve interfaces.

12.   The servo-valve control device according to Claim 11, wherein the extended observer is constructed to model the servo valve using a system matrix and an observer matrix which are independent of characteristic parameters of the servo valve.

13.   A servo-valve control system for controlling a servo

valve, the control system comprising:

(a) a triplex system of servo-valve control devices each including:

a controller, which is constructed to receive a signal of difference between the servo-valve opening target value and the actual servo-valve opening, and to generate a servo command signal for driving the servo valve;

an extended observer, which is constructed to receive the actual valve opening signal and the servo command signal, and to estimate an input-terminal disturbance signal added on the servo valve; and

a modification part, which is constructed to modify the servo command signal by subtracting the estimated input-terminal disturbance signal output from the extended observer, from the servo command signal;

(b) a triplex system of valve interfaces each including a power amplifier which is constructed to amplify one of the servo command signals from the servo-valve control devices to drive one of the servo valves;

(c) a triplex system of servo coils for driving the servo valves with current from the valve interfaces;

(d) an abnormality decision part for deciding that at least two valve interfaces are abnormal when all of the input-terminal disturbance signals are out of a pre-determined range; and

(e) a detecting logic for separating outputs of the power

amplifier sequentially, based upon operation of the abnormality decision part, and for subsequently detecting abnormal power amplifier system based upon change rate of the input-terminal disturbance signal output from the extended observer.

14. The servo-valve control device according to Claim 13, wherein the extended observer is constructed to model the servo valve using a system matrix and an observer matrix which are independent of characteristic parameters of the servo valve.

15. A servo-valve control system for controlling a servo valve, the control system comprising:

(a) a triplex system of servo-valve control devices each including:

a controller, which is constructed to receive a signal of difference between the servo-valve opening target value and the actual servo-valve opening, and to generate a servo command signal for driving the servo valve;

an extended observer, which is constructed to receive the actual valve opening signal and the servo command signal, and to estimate an input-terminal disturbance signal added on the servo valve; and

a function generator, which is constructed to tune at least one control parameter of the controller based upon the disturbance estimation signal from the extended observer;

(b) a triplex system of valve interfaces each including a

power amplifier which is constructed to amplify one of the servo command signals from the servo-valve control devices to drive one of the servo valves;

(c) a triplex system of servo coils for driving the servo valves with current from the valve interfaces;

(d) an abnormality decision part for deciding that at least two valve interfaces are abnormal when all of the input-terminal disturbance signals are out of a pre-determined range; and

(e) a detecting logic for separating outputs of the power amplifier sequentially, based upon operation of the abnormality decision part, and for subsequently detecting abnormal power amplifier system based upon change rate of the input-terminal disturbance signal output from the extended observer.

16.   The servo-valve control device according to Claim 15, wherein the extended observer is constructed to model the servo valve using a system matrix and an observer matrix which are independent of characteristic parameters of the servo valve.